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Effect of Structural Disorder on Hydrodynamic Behavior of Alpha-Casein According to PFG NMR Spectroscopy

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Abstract The concentration dependences of self-diffusion coefficient for intrinsically disordered milk protein α_S-casein were studied by pulsed field gradient nuclear magnetic resonance. The experimental data were analyzed in a view of phenomenological approach based on the frictional formalism of non-equilibrium thermodynamics by Vink. The results of α_S-CN hydrodynamic study showed that at low- and high-protein concentrations, α_S-CN exists in the different structural forms. At low concentrations in the rather broad concentration range, protein remains monomeric but with greater hydrodynamic size than have rigid globular proteins of the equal mass. At high concentrations beyond the definite protein content, α_S-CN tends to form associates. The application of the Vink's approach to α_S-CN testifies that the role of flexible domains in the process of self-diffusion is mainly in increasing the friction of between α_S-CN molecules due to their inter-entanglement. The latter physically means that when α_S-CN molecules cling each other by their flexible domains, this phenomenon provides much more efficient friction than their interaction with solvent molecules.

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